Toppersnotes
Unleash the topper in you

RRB-NTPC

CBT-I ,CBT-II

QUANTITATIVE

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Contents

NUMBER SYSTEM

Introduction

Numbers

- **Real Numbers**
  - Which Can be represented on number line
  - eg: −1, 0, 1, 2·3, 5/7
  - **Rational Number**
    - Which Can be written in form of p/q $(q \neq 0)$
    - eg: $-2/3$, $5/7$, 4, 1, $\sqrt{16}$
    - **Fraction/Decimal**
      - Which are in form of p/q or having Decimal
    - **Integer**
      - A Complete Number Which is not a fraction or decimal.
      - eg: −3, −71, −0, 1, 5, 243
      - [It Can be Positive, negative or zero]
  - **Irrational Number**
    - Which Can not be written in form of p/q.
    - eg: $\sqrt{5}$, $\sqrt{23}$, π, e
    - $\pi \Rightarrow$ Pie = 3·1457------
    - $e \Rightarrow$ 2·73828---------
- **Imergenary Numbers**
  - Which Can be not refresented On Number line
  - eg: i, $a+ib$
  - $i = i0 + a = \sqrt{-1}$
  - Such number no existin real

- **Whole Numbers:** Integers Starting from 0.
- **Natural Numbers:** Integers Starting from 1.
- **Prime Numbers:** The number which is divisible by 1 & no. itself is Called a Prime number.

eg: 2, 3, 5, 7, 11, 13 etc.

1 is not a Prime number

There are 25 Prime number b/w 1 to 100

- **Composite Number:** The number which have more than two factors are Called Composite numbers.

eg; 4, 6, 12, 21, 28 etc.

The numbers which are not prime are Composite Number

Co-Prime Number: Numbers having their HCF is 1 are termed as Co-prime Numbers.

eg: 14 & 15.

Even Number: Rational number which are the multiple of 2 is Called as even numbers.

eg: 2, 4, 6, 48, 92 .... etc.

Odd Number: Rational Numbers which are not multiple of 2 are Odd. Number.

eg: 1, 3, 5, 91, 103, 249 ....

even Numbers ending digit is 2, 4, 6, 8, 0 &   Odd Numbers ending digit is 1, 3, 5, 7, 9

Properties of Odd and even Numbers:

- even + even = Even
- ODD + ODD = Even
- Even + ODD = ODD
- Even + Even ---------- + n times = Even (always)
- Odd + Odd ---------- odd numbers of times = ODD
- ODD + ODD ---------- even number of times = Even
- Even x Even = Even
- Eved x odd = Even
- Odd x odd = Odd
- Even x (Even / odd) = Even

Decimal

Terminating

- Decimal Vanishes after some places

These No's Can be represented by – $1.\overline{23}$

Non-terminating

Eg: 1.23456789......
1.11111 ......
(Decimal never Vanishes)

Recurring

Digit of Decimal is repeat after some decimal places

Eg: 1.23232323......

These are rational Numbers

Non Recurring

- Digit of Decimal does not repeat

Eg: 1.233759257.

These are Irrational Number

Converting Recurring in P/q Form:

(Solving the – (Bar) Problems)

Eg: $x = 0.\overline{7}$, Convert x into P/q form.

Sol^n ⇒ $x = 0.7777 \ldots\ldots$ —①

$10x = 7.7777 \ldots\ldots$ —②

$9x = 7.0000$

$x = 7/9$

- if (–) on one digit = Multiply by 10
- if (–) on two digit → multiply by 100

Tricks

Type-1

(a) $x = 0.\overline{8}$

$x = \frac{8}{9}$ → As many digits Contain ('‾'), Write 9 as many times;-

(b) $x = 0.\overline{78}$

$x = \frac{78}{99} = \frac{26}{33}$ Ans

Type-II

(c) $x = 0.3\overline{84}$

$= \frac{384-3}{990}$ → Number After Decimal – Number not Contain bar
→ 9 as many digit in (‾), & 0 as many times not Contain (‾),

$= \frac{381}{990} = \frac{127}{330}$ Ans

$x = 52\overline{48}$

$= \frac{5248-52}{9900} = \frac{5196}{9900}$ $\frac{1732}{3300}$ Ans

Type-III

(a) $2.6\overline{5}$

$\Rightarrow 2+0.6\overline{5}$

$= 2+\frac{65-6}{90}$ (Same as type II)

$= 2+\frac{59}{90} = \frac{239}{90}$ Ans

(b) $5.\overline{95}$

$= 5+0.\overline{95}$

$= 5+\frac{95}{99}$

$= \frac{590}{99}$

Divisibility Rules :-

NUMBER	RULE	EXAMPLE
2	Last digit is divisible by 2, or last digit is 0, 2, 4, 6, 8.	Eg: 2348 1948
3	Sum of digit is divisible by 3.	Eg: 1071 1+0+7+1=9
4	last two digit of number is divisible by 4	14<u>32</u> 92<u>84</u>
5	Last digit is 5 or 0	2335, 1990
6	Number is divisible by 2 and 3 each	132 → divisible by 2 1+3+2 → divisible 3
7	• Multiply last digit by 5 • Add the above number • if remaing digits divisible by 7, then number is divided by 7	Eg: 343 (i) 3×5 = 15 34−15 = 49 ↓ divisible by 7.
8	Last 3 digit are divisible by 8	8032 → 32 Divisible by 8.
9.	Sum of digits is divisible by 9	1071 → 1+0+7+1 = 9 ↓ divisible by 9
11.	• Defrence of Sum of digit at odd Places & Sum of digit at even places.	• 1331 (3+1) − (3+1) = 0 • 11718520 (1+7+8+2) − (1+1+5+0) = 11

② If 3x2680, is divisible by 11, then the Value of x is :

Solⁿ: (Sum of Odd Place digit) – (Sum of Even Place digit)

$= (3+2+8) - (x+6+0)$

$= 13 - 6 - x$

$= 7 - x$ (Either 0 or divisible by 11)

$= 7 - x = 0$

$\boxed{x = 7}$ Ans.

Cyclicity:

Unit digit is repeated after some time of an exponent.

$2^1 = 2$	$3^1 = 3$	$4^1 = 4$	$7^1 = 7$
$2^2 = 4$	$3^2 = 9$	$4^2 = 16$	$7^2 = 49$
$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$7^3 = 343$
$2^4 = 16$	$3^4 = 81$	$4^4 = 216$	$7^4 = 2401$
$2^5 = 32$	$3^5 = 243$	Cyclicity = 2	$7^5 = 16807$
$2^6 = 64$	$3^6 = 729$		Cyclicity = 4
Cyclicity = 4	Cyclicity = 4		

$8^1 = 8$	$9^1 = 9$
$8^2 = 64$	$9^2 = 81$
$8^3 = 512$	$9^3 = 729$
$8^4 = 4096$	$9^4 = 6561$
$8^5 = 32768$	Cyclicity = 2
Cyclicity = 4	

Eg: $(2)^{423}$, Find the digit at units Place

Soln (a) divide the power by 4

In Exams divide in mind, not in Pen-Paper.

$$4 \overline{)423} (105$$
4
23
20
3

Remainder = 3

$2^3 = 8$ Ans

Unit digit and ten's digit Concept-

★ 1 2 3 4
- 4 → Unit digit
- 3 → Ten's digit

Eg: **Type-I**

(a) 29 x 45 = 9 x 5 = 4⑤ Unit digit = 5

(b) 18 x 18 x 18 + 3

8 x 8 x 8 + 3

64 x 8

32 + 3 = 35 ⇒ = 5

Type = II

(a) (0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
↓
Cyclicity Concept

(b) (0, 1, 5, 6)
↓
If there number are at unit place unit digit of multiplication is also a same number.

Eg; (a) 35 x 35 = 1225 → Same (b) 36 x 96 = 3456 → Same

Helping Hand:-

(a) Divide the Power by 4.

(b) Remainder of division is 0, 1, 2, 3...

(c) Remainder ⇒ 1 = x^1 is unit digit
Remainder ⇒ 2 = x^2 is unit digit
Remainder ⇒ 3 = x^3 is unit digit
Remainder ⇒ 0 = x^4 is unit digit

If x^4 is 2 or 3 digit number, then unit digit of that number, will be the unit digit of original Exponent.

Solved Examples

① What least number must be added to 1056, So that Sum is Completely divisible by 23?

Soln ⇒
```
23) 1056 (45
    92
    ---
     136
     115
     ---
      21
```
then Number added is = 23-21
= 2 Ans

② The largest 4 digit number exactly divisible by 88 is –

(a) 9944 (b) 9768 (c) 9988 (d) 8888

Soln ⇒ Largest 4 digit Number = 9999

```
88) 9999 (113
    88
    ---
    119
     88
    ---
     319
     264
     ---
      55
```
55 ⟶ Subtract from the 4 digit largest number.

= 9999−55 = 9944 Ans

③ If the number 517 * 324 is Completely divisible by 3, then the Smallest whole no. in place of * will be.

(a) 0 (b) 1 (c) 2 (d) None

5+1+7+*+3+2+4
=22+*

If number is divisible by 3, then sum of digit is also divisible by 3.

If 2 is used in place of *, then number is divisible by 3 (i.e-24)

④ Which one of the following no. is divisible by 11?

(a) 235641 (b) 245642 (c) 315624 (d) 415624

Soln ⇒ (a) 235641
(2+5+4) − (3+6+1) = 1 (not divisible by 11)

(b) 245642
(2+5+4) − (4+6+2) = 1 (not divisible by 11)

(c) 315624
(3+5+2) − (1+6+4) = −1 (not divisible by 11)

(d) 415624
(4+5+2) − (1+6+4) = 0 (divisible by 11)

If a number is divisible by 11, the Difference of Sum of digit at odd places & Sum of digit at even places is either 0 or divisible by 11.

⑤ Which on the following number is divisible by 24 -

Soln ⇒ (a) 35718 (b) 63810 (c) 63810 (c) 537804 (d) 3125736

	③	⑧
35718	3+5+7+1+8 = 24 ✓	718 ✗
63810	6+3+8+1+0 = 18 ✓	810 ✗
537804	5+3+7+8+0+4 = 27 ✓	804 ✗
3125736	3+1+2+5+7+3+6 = 27 ✓	736 ✓ ✓

If a no. is divisible by another number then it must be divisible by it's prime factors.

Unit digit Concept:

⑥ The digit at unit's place of the Product –

$81 \times 82 \times 83 \ldots\ldots \times 89$ is

(a) 0 (b) 2 (c) 6 (d) 8

Soln ⇒ $81 \times 82 \times 83 \times 84 \times 85 \ldots \times 89$

$1 \times 2 \times 3 \times 20 \ldots \times 6 \times 7 \times 8 \times 9$

$= 0$

If we multiply a number by 0, the result at unit place is always zero.

⑦ The digit in unit's Place of the Product $(2153)^{167}$ is:

(a) 1 (b) 3 (c) 7 (d) 9

Soln ⇒ 215<u>3</u> ⟶ Let base is 3

ⓑ $\frac{167}{4}$ ⇒ Remainder is 3

ⓒ $3^3 = 27$ → unit digit is 7

⑧ Unit digit in $(264)^{102} + (264)^{103}$ is –

ⓐ 0 (b) 4 (c) 6 (d) 8

Soln ⇒ $(264)^{102} + (264)^{103}$

$= 6 + 4$

$= 10$

unit digit = 0

> If Base is 4, then
> (a) ⇒ Unit digit of even power is always 6
> (b) ⇒ Unit digit of odd Power is always 4.
> because Cyclicity is 2

⑨ Unit digit of $(169)^{537} + (94)^{394}$ is.

(a) (b) (c) (d)

Soln ⇒ $(169)^{537} + (94)^{394}$

$\downarrow$ $\downarrow$

$= 9 + 6$

$= 15$

= unit digit is 5 Ans

If the Base is 9
(a) Unit digit of ODD Power is always 9.
(b) unit digit of even Power is always 1.
because Cyclicity is 2.

⑩ The digit in the unit place of
$[(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35} - (16)^4 + 259 + (73)$ is —

(a) 1 (b) 4 (c) 5 (d) 6

Soln ⇒ $(251)^{98} + (21)^{29} - (106)^{100} + (705)^{35} - (16)^4 + 259 + (73)^{51}$

$1 + 1 - 6 + 5 - 6 + 9 + 7$

Unit digit of base 1, 5, 6, is always Same

$\frac{51}{3}$ = Remainder 3

$3^3 = 27$

$= 23 - 12 = 11$ Ans

⑪ Unit digital in expression of $(2137)^{754}$ is —

(a) 1 (b) 3 (c) 7 (d) 9

Soln ⇒ $(2137)^{754}$ → Base is 7

$\frac{754}{4}$ Remainder = 2

$7^2 = 49$ → unit digit is 9 ✓

⑫ Find the unit's digit of $(358)^{64} - (253)^{36}$.

(a) 5 (b) 4 (c) 7 (d) 9

Soln ⇒ $(358)^{64} - (253)^{36}$

$\frac{64}{8}$ $\frac{36}{3}$

0 → Remainder ← 4 → 3^4

$8^4 = 64 \times 64 = 16 - 1$

⇒ 6 − 1
= 5 Ans

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solved Examples

1- what least number must be added to 1056, so that sum is completely divisible by 23?

(a) 2 (b) 2 (c) 18 (d) 21

sol.

```
23 ) 1056 ( 45
     92
     ---
      136
      115
      ---
       21
```

then number added is

$= 23-21$
$= 2.$

2- The largest 4 digit number exactly divisible by 88 is-

(a) 9944 (b) 9768 (c) 9988 (d) 8888

sol.

Largest 4 digit Number = 9999

```
88 ) 9999 ( 113
     88
     ---
      119
       88
      ---
       319
       264
       ---
        55  --> Subtract from the 4 digit Largest number
```

$= 9999 - 55$
$= 9944.$

3- If the number 517x324 is completely divisible by 3, them the smallest whole no. in place of x will be-

(a) 0 (b) 1 (c) 2 (d) None

sol.

$5+1+7+H+3+2+4$
$= 22+H$

> If number indivisble by 3 them sum of digit is also divisible by 3.

If 2 is used in place of H, then number is divisble by 3 (i.e. 24)

4- which one of the following no. is divisible by 11?

(a) 235641 (b) 245642 (c) 315624 (d) 415624

sol. (a) 235641
(2+5+4)-(3+6+1) = 1 (not divisible by 11)

(b) 245642
(2+5+4) - (4+6+2) = -1 (not divisible by 11)

(c) 315624
(3+5+2) - (1+6+4) = -1 (not divisible by 11)

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(4+5+2) - (1+6+4) = 0 (divisible by 11)

If a number is divisible by 11, the Difference of Sum of digit of digit at odd places & Sum of digits of even place is either 0 or divisible by 11.

5- which on of the following no. is divisible by 24?

(a) 35718 (b) 63810 (c) 537804 (d) 3125736

sol.

	③	⑧
35718	3+5+7+1+8 = 24 ✓	718 x
63810	6+3+7+8+1+0 = 18	810 x
537804	5+3+7+8+0+4 = 27	804 x
✓ 3125736	3+1+2+5+7+3+6 = 27	736 ✓

If a no. is divisible by another number, then it must be divisible by its Prime factors

6- The digit at unit's place of the product 81 × 82 × 83...× 89

(a) 0 (b) 2 (c) 6 (d) 8

sol. 81 x 82 x 83 ------ x 89 is

✓(a) 0 (b) 2 (c) 6 (d) 8

Soln ⇒ 81 x 82 x 83 x 84 x 85 .... x 89
1 x 2 x 3 x 20 .... x 6 x 7 x 8 x 9
= 0

If we multiple a number of 0, the result at unit place is always zero.